

Microfluidics μ FACS for Life Detection

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ABSTRACT

A prototype micro-scale Fluorescent Activated Cell Sorter (μ FACS) for life detection has been built and is undergoing testing. A functional miniature microfluidics instrument with the ability to remotely distinguish live or dead bacterial cells from abiotic particulates in ice or permafrost of icy bodies of the solar system would be of fundamental value to NASA. The use of molecular probes to obtain the bio-signature of living or dead cells could answer the most fundamental question of Astrobiology: Does life exist beyond Earth? The live-dead fluorescent stains to be used in the μ FACS instrument function only with biological cell walls. The detection of the cell membranes of living or dead bacteria (unlike PAH's and many other Biomarkers) would provide convincing evidence of present or past life. This miniature device rapidly examine large numbers of particulates from a polar ice or permafrost sample and distinguish living from dead bacteria cells and biological cells from mineral grains and abiotic particulates and sort the cells and particulates based on a staining system. Any sample found to exhibit fluorescence consistent with living cells could then be used in conjunction with a chiral labeled release experiment or video microscopy system to seek addition evidence for cellular metabolism or motility. Results of preliminary testing and calibration of the μ FACS prototype instrument system with pure cultures and enrichment assemblages of microbial extremophiles will be reported.

Keywords: Microfluidics, cell sorting, cell counting, live-dead staining, fluorescence

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